DOCUMENT RESUME

ED 207 999 TM 810 664

AUTHOR Singh, Balwant; And Others
TITLE The Development and Analysis of a Grade Eight Physical Science Test.
INSTITUTION Portland Public Schools, Maine.
PUB DATE 80
NOTE 15p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Grade 8; Item Analysis; Junior High Schools; *Multiple Choice Tests; *Physical Sciences; Pretests Posttests; *Science Tests; Test Reliability

ABSTRACT

This 46-question multiple choice test deals with the physical and chemical properties of matter, wave motion and types of energy, simple machines, equipment safety and measurement. The test is meant for administration to grade 8 students before and after instruction. Item analysis of the pre- post data are included, as are reliability estimates (standardized Item-Alpha) which range from .76 for the pretest to .84 for the post-test. (Author/GK)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

PORTLAND PUBLIC SCHOOLS

331 VERANDA STREET
PORTLAND, MAINE 04103

Central Office

ED207999

THE DEVELOPMENT AND ANALYSIS OF A GRADE EIGHT PHYSICAL SCIENCE TEST

Balwant Singh, Collette Cyr and John Serber
Portland Public Schools, Portland, Maine

Summary

The 46 multiple choice questions on the test deal with physical and chemical properties of matter, wave motion and types of energy, simple machines, equipment safety and measurement. The test was administered to students in grade 8 before and after instruction. Item-analyses of the pre-post data are enclosed for those interested in further refining the test. The reliability estimates (standardized Item-Alpha) are quite high and range from .76 for the pre-test to .84 for the post-test.

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

B. Singh

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TM 810 669

An Affirmative Action Employer

Science Tests

Grades 7 and 8

1980-81 School Year

DIRECTIONS FOR THE TEST ADMINISTRATOR

Before Testing

1. Distribute the sheet consisting of the Table of Specifications a week before the administration of the test.

2. Have the student identification parts of the answer sheets completed before administering the test. One of the sides of the answer sheets contains an example. The side which does not have an example should be completed as follows:

    a. At the upper left corner, print the student name, school name, etc.

    b. Do not complete the student number box at the upper right corner of the answer sheet.

    c. On the right side, print the first initial, middle initial and last name, in the spaces provided.

During Testing

1. Make sure that the students do NOT write on the tests; student names, answers to test questions, etc., should be written on the IBM answer sheets provided.

2. Number 2 pencils must be used on the answer sheets.

3. Instruct the students to darken the space under the answer of their choice; if they change their minds, they should erase the first one completely.

4. Read the 'Note' in the beginning of the test and the directions which follow, to the students as they read those to themselves.

A PHYSICAL SCIENCE TEST: Grade 8

Maximum Points: 46 Time: 40 Minutes

Directions: Please do not write anything on this test. Use the answer sheet provided. Select the best answer to the following questions and darken the spaces under the answers of your choice, by using number 2 pencils. If you change your mind, erase your first answer completely.

1. The mental picture we use to describe something that cannot be seen is known as which one of the following?

   a. Scientific guess
   b. Scientific model
   c. Theory
   d. Hypothesis

2. Clue is to detective as _____ is to scientist. Which one of the following words best completes the above sentence?

   a. Science
   b. Observation
   c. Experiment
   d. Work
   e. Book

3. Which one of the following is the basic unit of length in the metric system?

   a. Meter
   b. Millimeter
   c. Centimeter
   d. Kilometer
   e. Gram

4. An object has a mass of 20 grams and its volume is 10 cubic centimeters. What is the density of the object?

   a. $1g/cm^2$
   b. $1g/cm^3$
   c. $2g/cm^2$
   d. $2g/cm^3$
   e. $.5g/cm^3$

5. Which one of the following methods is the best way to find the volume of a rock?

   a. Measure each side as accurately as possible.
   b. Find its mass and estimate its volume.
   c. Compare it to objects of a known volume.
   d. Immerse it in water and measure the amount of water displaced.

6. Experiment is to equipment as cooking is to _____.

   a. ingredients
   b. kitchen
   c. utensils
   d. appliances

7. How many grams does $24cm^3$ of H_2O weigh?

   a. 12g
   b. 24g
   c. 36g
   d. 48g

8. Which one of the following refers to the temperature at which all motion of matter stops?

   a. Freezing point
   b. Heat of fusion
   c. Absolute zero
   d. Kelvin temperature

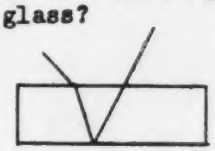
9. The amount of heat energy needed to raise 10 grams of water 3 degrees celsius is

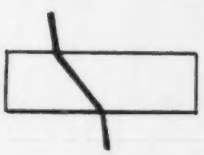
   a. 3 calories
   b. 9 calories
   c. 15 calories
   d. 30 calories
   e. 60 calories

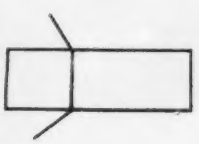
10. Which one of the following terms best describes a disturbance caused by energy moving from one place to another?

    a. Force
    b. Potential energy
    c. Work
    d. Electricity
    e. Wave

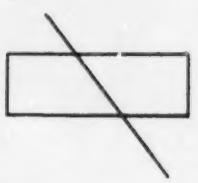
11. Which one of the following best describes the passage of a light wave through a block of glass?

a. 

b. 

c. 

d.

e. 

12. Find the speed of a wave that has the frequency of 1 wave/sec and a wavelength of 5 meters.

    a. 5m/sec
    b. 2m/sec
    c. 5m
    d. .2m

13. The loudness of a sound is determined by its

a. wavelength
b. frequency
c. amplitude
d. velocity
e. Doppler effect

14. If you pet your cat, your hand will gain electrons. This will produce which one of the following situations? Your hand will be _____.

a. positive and the cat neutral
b. positive and the cat negative
c. negative and the cat neutral
d. negative and the cat positive

15. A circuit with 120 volts and a resistance of 4 ohms has a current flow of _____.

a. 7.5A
b. 15A
c. 30A
d. 480A

16. 30% of Maine's electricity is supplied by _____.

a. solar energy
b. chemical energy
c. nuclear energy
d. hydro energy

17. Child is to mother as fossil fuel is to

a. coal
b. sun
c. oil
d. gas
e. nuclear

18. In which situation is the force of friction greater than the force of gravity?

a. A marble rolling down an inclined plane
b. A rock resting on the side of a hill
c. A car rolling down a hill
d. A bolt being held by a magnet
e. A spaceship orbiting the earth

19. Which one of the following discovered the laws of motion?

a. Albert Einstein
b. Charles Darwin
c. Sir Isaac Newton
d. Benjamin Franklin

-over-

20. A simple machine that has a straight bar mounted on a fulcrum is a/an _____.

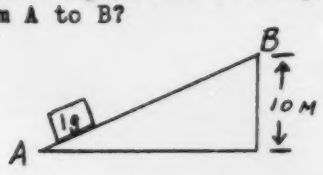
a. wheel
b. lever
c. inclined plane
d. wheel and axle
e. block and tackle

21. Which one of the following simple machines is a lever?

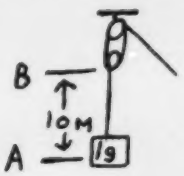
a. Scissors
b. Drill
c. Clock
d. Turbine

22. Which diagram shows the greatest amount of work being done by moving the object from A to B?

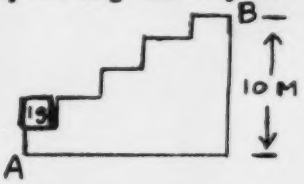
a.



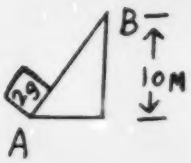
c.



e.



b.



d.

23. The smallest particle of a substance that has the properties of that substance is a/an

a. element
b. molecule
c. electron
d. crystal

24. Which one of the following elements has the lowest atomic mass?

a. Hydrogen
b. Copper
c. Oxygen
d. Uranium

25. What is the atomic mass of an atom that has 6 electrons, 6 protons and 5 neutrons?

a. 5 amu
b. 6 amu
c. 8 amu
d. 11 amu
e. 12 amu

26. Which one of the following chemical formulas indicates an element?

a. HCL
b. Os
c. $C_6H_{12}O_6$
d. H_2O

27. How many atoms of carbon are indicated by this formula: $2C_{12}H_{22}O_{11}$

a. 11
b. 24
c. 44
d. 45

28. Which one of the following changes of state would require the greatest kinetic energy?

a. Ice to water
b. Ice to vapor
c. Vapor to water
d. Water to vapor

29. How many electrons are there in the 2nd shell of an atom with 6 protons?

a. 4
b. 6
c. 8
d. 16

30. The atomic mass of carbon is 12 amu. Which one of the following statements best describes carbon? Carbon has _____.

a. 12 electrons, 8 protons and 4 neutrons
b. 12 electrons, 12 protons and 0 neutrons
c. 6 electrons, 12 protons and 0 neutrons
d. 6 electrons, 6 protons and 6 neutrons

31. There is an isotopic form of carbon that has an atomic mass of 14 amu. Which of the following would be the correct structure for carbon 14?

a. 12 protons, 2 neutrons
b. 12 protons, 2 electrons
c. 6 protons, 8 electrons
d. 6 protons, 8 neutrons

32. Which one of the following electron arrangements indicates an atom with a very stable structure?

a. 2,8,2
b. 2,6
c. 2,7
d. 2,8

-over-

33. Which one of the following would be a true solution?

a. Sand and water
b. Pepper and salt
c. Salt and water
d. Smoke and air

34. Which one of the following solutions has the highest concentration of acid?

a. 5ml of HCl in 1 liter of H_2O
b. 2.5ml of HCl in 1 liter of H_2O
c. 5ml of HCl in .5 liter of H_2O
d. 2.5ml of HCl in .5 liter of H_2O

35. A substance that changes the speed of a chemical reaction but remains the same is called a/an _____.

a. catalyst
b. ionizer
c. product
d. reactant

36. Which one of the following is an example of a chemical change?

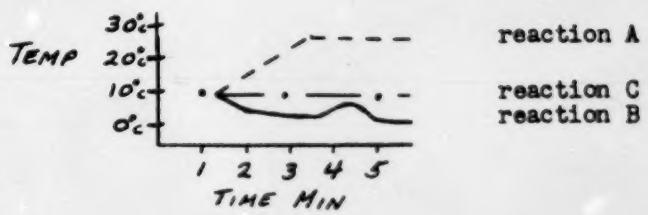
a. Sugar dissolving
b. Ice melting
c. Wood burning
d. Glass breaking

37. Select the correct product for the following chemical reaction: $HBr + LiOH \longrightarrow$ _____.

a. $Li_2 + BrOH$
b. Li_2BrOH
c. $LiBr + H_2O$
d. $LiH + BrOH$

38. Which reaction in the following graph is endothermic?

a. reaction A
b. reaction B
c. reaction C
d. none of the above



39. Which one of the following is an acid?

a. HOH
b. NaOH
c. $HC_2H_3O_2$
d. H_2
e. HgO

Go to next page

40. Which one of the following indicates a basic compound?

a. HOH
b. Na_2SO_4
c. $Ba(OH)_2$
d. H_2SO_4

41. The reason that sodium (Na^+) and chlorine (Cl^-) will react is that in order to complete their outermost shells,

a. they both need to gain an electron
b. they both need to lose an electron
c. sodium needs to lose one electron and chlorine needs to gain one electron
d. sodium needs to gain one electron and chlorine needs to lose one electron

42. Which one of the following is a balanced chemical equation showing the reaction of hydrogen and oxygen atoms?

a. $H + O \longrightarrow H_2O$
b. $H_2 + O_2 \longrightarrow H_2O$
c. $2H_2 + O_2 \longrightarrow 2H_2O$
d. $2H_2 + O \longrightarrow 2H_2O$

43. Two objects with the same electrical charge will attract each other.

a. True
b. False

44. Lightning is the jumping of protons from one place to another.

a. True
b. False

45. Most environmental problems are a result of the Industrial Revolution.

a. True
b. False

46. To change a substance from one state into another <u>does not</u> require any energy changes.

a. True
b. False

If you finish before time is called, check your work on this test. Thank you.

School Year 1980-81

Grade 8

PHYSICAL SCIENCE TEST

TABLE OF SPECIFICATIONS

TOPIC	KNOWLEDGE OR RECALL	HIGHER THAN KNOWLEDGE OR UNDERSTANDING AND THINKING	SUB-TOTAL	TOTAL
Scientific Method	0	2	2	
Equipment, Safety and Measurement	1	4	5	
Wave Motion and Types of Energy	4	8	12	
Simple Machines and Motion	2	4	6	
Physical Properties of Matter	5	6	11	
Chemical Properties of Matter	4	6	10	
Sub-total	16	30		
Total				46

Corrected Item-Analysis Data Sheet

PHYSICAL SCIENCE PRE TEST

GRADE 8 FALL, 1980

ITEM #	ITEM DIFFICULTY	ITEM DISCRIMINATION	CHOICES PERCENTAGE SELECTING EACH					
			A	B	C	D	E	OTHERS
1	.18	.14	15.6	17.6	34.7	26.3		5.9
2	.33	.30	9.2	32.8	49.8	2.5	1.1	4.7
3	.75	.38	75.0	3.0	10.6	3.4	2.8	5.3
4	.30	.27	8.9	11.2	32.0	29.9	13.1	5.0
5	.35	.31	13.4	26.3	19.4	34.7		6.2
6	.38	.32	29.5	13.7	38.4	12.9		5.5
7	.34	.23	18.4	33.7	17.1	24.7		6.1
8	.27	.21	47.7	7.2	27.1	12.9		5.2
9	.45	.24	11.4	15.4	17.3	45.3	5.4	5.3
10	.26	.20	24.1	15.4	11.2	19.0	25.5	4.9
11	.23	.26	13.1	22.6	10.4	8.7	40.1	5.1
12	.65	.36	64.5	11.5	12.4	6.1		5.5
13	.27	.26	20.2	31.3	27.1	11.2	5.0	5.3
14	.29	.09	18.5	28.8	17.7	28.9		6.1
15	.47	.29	6.8	10.4	47.0	28.9		6.8
16	.58	.22	14.3	9.3	58.2	12.9		5.4
17	.13	.007	35.6	13.2	20.5	15.2	9.8	5.6
18	.23	.24	12.8	23.2	12.4	25.7	20.8	5.1
19	.63	.36	14.2	12.4	62.8	5.6		5.0
20	.56	.36	4.8	56.3	12.1	17.6	3.9	5.3
21	.55	.38	54.6	11.2	7.6	20.1		6.5
22	.40	.26	5.3	39.5	9.5	5.8	34.7	5.3
23	.44	.27	17.3	44.2	23.5	8.7		6.4
24	.21	.17	20.8	26.3	32.8	13.5		6.5

25	.25	.13	11.0	15.4	17.3	24.9	25.8	5.6
26	.14	.20	12.1	14.5	23.0	43.5		6.8
27	.33	.27	14.6	33.0	17.0	29.2		6.3
28	.38	.32	17.9	38.4	18.2	20.2		5.3
29	.20	.18	20.4	24.0	36.5	13.1		6.1
30	.31	.15	21.9	21.0	19.6	30.9		6.5
31	.20	.09	17.7	27.2	28.3	20.1		6.7
32	.16	.03	40.4	22.4	14.2	16.3		6.7
33	.49	.27	8.6	18.2	48.5	18.7		6.1
34	.42	.25	21.0	16.3	41.7	15.1		5.9
35	.16	.13	15.9	25.2	16.5	35.8		6.7
36	.31	.23	35.3	22.4	30.6	5.4		6.2
37	.30	.07	10.7	21.8	30.0	29.4		8.1
38	.23	.15	15.9	23.2	23.3	28.5		9.2
39	.29	.12	8.2	25.7	29.4	11.2	17.7	7.8
40	.26	.03	18.0	21.5	25.7	24.9		10.0
41	.40	.20	16.2	20.8	39.5	17.1		6.4
42	.18	-.001	19.9	36.1	18.0	19.1		6.9
43	.53	.32	38.4	52.9				8.7
44	.38	.14	52.3	38.4				9.3
45	.54	.36	54/0	38.1				7.9
46	.67	.34	23.0	66.9				10.2

# of students = 643 Mean = 16.36 Standard deviation = 6.11

Reliability = .76

Corrected Item-Analysis Data Sheet

PHYSICAL SCIENCE POST TEST

GRADE 8 SPRING, 1981

ITEM #	ITEM DIFFICULTY	ITEM DISCRIMINATION	CHOICES PERCENTAGE SELECTING EACH					
			A	B	C	D	E	OTHERS
1	.55	.29	8.9	54.9	21.6	13.6		1.0
2	.36	.20	7.7	36.0	53.5	0.9	0.9	1.0
3	.80	.26	80.1	0.7	12.9	2.9	2.4	1.0
4	.34	.19	9.6	10.1	35.3	34.1	9.8	1.0
5	.56	.24	8.7	19.4	13.7	56.3		1.9
6	.62	.19	23.2	5.0	62.3	9.1		0.5
7	.42	.27	15.6	41.5	14.1	27.8		1.0
8	.62	.50	24.0	2.1	61.6	11.8		0.5
9	.60	.32	14.8	11.0	10.8	59.9	3.1	0.5
10	.37	.24	18.0	19.6	9.9	15.3	36.7	0.5
11	.57	.40	11.5	57.5	8.7	2.7	18.9	0.7
12	.77	.32	76.7	7.4	12.0	3.6	..	0.3
13	.33	.25	13.7	43.9	32.9	5.8	3.3	0.3
14	.45	.23	12.5	26.9	14.9	44.8		0.8
15	.60	.34	2.9	9.6	59.9	26.1		1.6
16	.54	.12	15.8	6.9	54.2	22.1		1.0
17	.21	.14	42.0	20.6	19.4	9.6	7.9	0.5
18	.32	.31	10.1	32.1	12.5	22.0	22.3	1.0
19	.70	.29	14.1	12.9	70.5	2.2		0.4
20	.66	.30	1.9	66.4	17.2	10.8	3.4	0.3
21	.69	.37	69.3	5.3	5.0	19.2		1.2
22	.48	.28	4.6	48.2	6.3	3.8	36.9	0.2
23	.62	.26	20.1	62.3	12.3	3.9		1.3
24	.73	.46	72.7	5.1	12.3	9.1		0.7
25	.43	.38	7.7	16.3	8.9	43.2	23.5	0.3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.2

24	.73	.46	72.7	5.1	12.3	9.1		0.7
25	.43	.38	7.7	16.3	8.9	43.2	23.5	0.3
26	.36	.39	11.3	36.4	13.7	37.4		1.2
27	.69	.46	5.8	68.6	6.7	18.5		0.4
28	.54	.32	11.3	53.7	18.0	15.4		1.5
29	.66	.46	65.5	11.8	19.9	1.9		0.9
30	.50	.28	16.5	20.8	9.9	49.9		3.0
31	.28	.25	17.8	17.5	34.6	28.5		1.6
32	.55	.41	25.2	13.0	5.3	55.4		1.0
33	.71	.29	6.5	9.8	71.2	12.2		0.3
34	.51	.32	23.7	12.2	50.9	11.8		1.4
35	.60	.44	60.4	11.1	8.4	18.9		1.2
36	.50	.37	25.0	20.4	50.3	3.8		0.5
37	.52	.31	7.5	13.7	51.6	25.7		1.4
38	.27	-.01	26.8	26.6	14.8	29.8		2.1
39	.35	.19	8.6	33.3	35.2	8.6	12.3	2.1
40	.27	.11	22.6	28.8	27.3	18.2		3.1
41	.62	.21	8.6	11.0	62.1	17.7		0.7
42	.33	.24	14.4	20.6	33.3	30.5		1.2
43	.84	.29	14.9	83.5				1.6
44	.42	.26	55.2	42.4				2.4
45	.66	.27	66.4	32.2				1.4
46	.80	.25	17.3	79.8				3.0

SUMMARY STATISTICS

# of students = 583 Mean = 24.33 Standard Deviation = 7.52

Reliability - Standardized Item Alpha = .84